SERVICE MANUAL

HACKER RADIO LTD.

NORREYS DRIVE·COX GREEN·MAIDENHEAD
BERKS
TELEPHONE 22231

Confidential

Not for publication

HACKER 'SOVEREIGN' MODEL RP18 SERVICE MANUAL

CONTENTS

HACKER 'SOVEREIGN' MODEL RP18

1. GENERAL DESCRIPTION

The Hacker 'Sovereign' is a 15 transistor (plus 7 diodes) portable radio receiver, designed for the highest possible quality reception of both AM and FM VHF broadcasting from a portable receiver.

It features two separate tuners, one for AM reception and the other for FM, with common controls and amplifier.

This dual receiver arrangement has many advantages in design and eliminates many disadvantages of combined receivers using common transistors and components.

High sensitivity is essential for good FM reception and this is ensured by four I.F. stages.

2. TECHNICAL DESCRIPTION

Special Features:–

1) Automatic Frequency Control (AFC) on FM with 'Quiet Tuning' button for noiseless tuning and local station identification.
2) Common tuning control for AM and FM.
3) Separate tuner and IF strip for AM and FM with common amplifier.
4) Push button wavechange and 'quiet' tuning control.
5) Three adjustable station markers for FM local stations.
6) 10" ferrite rod aerial for AM and telescopic rod for FM.
7) Facilities include:–
    a) External socket for AM or FM aerial.
    b) Audio output at diode level for tape recording.
    c) Audio input socket for gramophone pick up microphor or tape replay.
    d) Output for personal earphone.
8) Large elliptical 8" x 5" speaker delivering 1.2 watts output fro push-pull audio amplifier.
9) Direct coupled, transformerless audio amplifier (negative eart

Operating Controls:–

Volume control/On-Off switch. Independent Bass and Treble controls. Push button function switch.

Transistors and Diodes

	Circuit Ref.	Type	Purpose
(AM Tuner)	T1	AF117	Osc./Mixer
	T2	AF117	IF amplifier
	T3	AF117	IF amplifier
	CR1	OA79	Overload diode
	CR2	OA90	Detector
(FM Tuner)	T4	AF121	RF amplifier
	T5	AF125	Osc./mixer
	T6	AF114	IF amplifier
	T7	AF114	IF amplifier
	T8	AF114	IF amplifier
	T9	AF114	IF amplifier/limiter
	CR3	BA112	AFC diode
	CR4	OA79	AGC diode
	CR5) CR6)	OA79	FM detector
(Amplifier)	TR1	OC71	High impedance stage (Emitter follower)
	TR2	OC75	Audio amplifier
	TR3	AC127	Audio amplifier
	TR4	OC81D	Driver
	TR5) TR6)	AC127 OC81	Push pull output

Waveband Coverage

AM 185 – 560 metres Medium Wave and 1000 – 1850 metres Long Wave.
FM 87 – 101 Mc/s.

Audio Frequency Response

30 c/s – 20 Kc/s ± 2db

Battery Consumption (measured at zero volume)

AM 14M/A (approx)
FM 18M/A (approx)

Output

1.2 watts

Batteries

2 – PP9 Every Ready (or equivalent).

Dimensions

Overall width 12¾" Overall Height 8¾" Depth 4¾"

Weight

9lb. 6oz including batteries (11lb. 8 oz. packed in carton).

Speaker

8" x 5" 30 ohms impedance.

3. CIRCUIT DESCRIPTION

AM Operation

Signals are picked up on a ferrite rod aerial tuned by L1 C3 C4 on Medium Wave and L2 C3, C4, C6 and C7 on Long Wave. They are fed to the base of T1 (AF117) via C5 (.01). T1 operates as an oscillator/mixer with tuned oscillator circuit L3, C14, C15 on Medium Wave supplemented by the addition of C11 on Long Wave. L4 primary winding is included in the collector circuit of T1 and is tuned to the IF frequency of 470Kc/s. The diode CR1 prevents overloading on strong signals and operates by providing a damping action on L4.

Signals appearing at the secondary of L4 are fed to the base of T2 (AF117) which is an IF amplifier having the 2nd IF transformer L5 primary in its collector circuit. R7, C20 provide reverse bias for CR1. The IF signal is then passed to T3 (AF117) which is another IF amplifier stage with L6 the 3rd IF transformer primary included in its collector circuit.

The detector diode CR2 is fed from the secondary of L6 and after filtering by components C26, R14, C27 the audio signal is passed via the FM/AM selector switch and C75, R16 and C29 to the volume control RV1. The tape output and Gram input sockets are included at this point.

The DC component of CR2 is used as A.G.C. and fed via R9, L4 to control the gain of T2.

FM Operation

When the receiver is switched to FM, the telescopic rod aerial picks up signals and passes them via C30 to the broad tuned RF transformer L7, the secondary of which is tuned by C31. T4 (AF121) is a grounded base RF amplifier having in its collector circuit L8 which is permeability tuned and ganged to the variable oscillator inductance (L10). C34 and C35 provide the capacitive element, C35 being the RF trimmer adjustment. A.G.C. is applied to the base of T4 via R21 from T6. C36 passes the RF signal to T5 (AF125) which is an oscillator/mixer stage. The oscillator circuit comprises L10, C42, C44, C45 and CR3, C42 being the oscillator trimmer. CR3, C45 are part of the AFC circuit providing a variable capacitive element to the tuner circuit dependent upon the control voltage fed via R23 from the discriminator. The two transistors T4 and T5 together with the associated components and coils plus the 1st IFT from the VHF tuner unit are physically contained in a separate unit.

NOTE:–It is recommended that service to this unit should be confined to measurement of the test voltage and alignment and should be returned to the works if any other service is required.

The 1st IF transformer (L11) is tuned to the IF frequency (10.7Mc/s) and IF signals appearing in the collector circuit of T5 are conveyed to the base of T6 (AF114) via C50.

T6, T7 (AF114) and T8 (AF114) form a 3 stage IF amplifier whose circuit elements are very similar in each case with the exceptions of (i) the addition of R28 which is a variable resistor providing adjustment of the base voltage of T6 and therefore sets the level at which the A.G.C. operates, and (ii) the inclusion of R33 in the emitter circuit of T7 which provides preset adjustment of IF gain. CR4 with its associated components providing AGC to control the gain of T6 stage.

The FM detector circuit is the conventional balanced ratio detector, employing two crystal diodes CR5 and CR6. The AFC operating voltage is obtained via R45, R44 and the tertiary winding of L15 from the resultant DC output, positive or negative as the case may be, from CR5, CR6.

The audio signal is fed via the de-emphasis components (R46, C28) and the selector switch, to the volume control RV1.

Provision is made for switching out the AFC when the 'quiet tuning' button is depressed. This is achieved by shorting the AFC line to chassis whilst at the same time reducing the IF sensitivity by a change of bias voltage on the base of T6.

Audio Amplifier

Audio signals from either the AM panel or the FM panel may be switched at will by the selector switch, to the audio amplifier via the volume control (RV1) and the 5 pin plug and socket (PL1/SK1).

The first audio amplifier transistor TR1 (OC71) is fed with signals to its base via C1 (2mfd) and offers a high impedance input by virtue of the negative feedback applied via R3 and C3. The output of TR1 is A/C coupled to the base of TR2 (OC75) for further amplification and the tone control circuits follow, comprising C6, RV1 (treble control) and C8, RV2 (bass control). Again, AC coupling is employed to the base of TR3 (AC127) which is an N-P-N transistor permitting direct coupling to the driver stage TR4 (OC81D) which facilitates phase inversion for TR5 and TR6.

TR5 (AC127) and TR6 (OC81) are the Class B push-pull output pair, TR5 being an N-P-N transistor thus enabling direct coupling to be employed and eliminating entirely the use of audio transformers. Voltage stabilization to the base of TR5 and TR6 is maintained by the use of SD1 which enables operation at low battery volts. Temperature stabilization is provided by R22 which is a temperature conscious resistance which corrects for varying degrees of operating temperature. RV4

provides a means of setting the quiescent currents in the output stage and RV3 controls the mid-point voltage. This is an important operation in the setting up procedure in conjunction with the adjustment of RV4 and these adjustment details are given under 'Test Specification', (a) Audio Amplifier.

Negative feedback is used to maintain the frequency response and decrease distortion. AC and DC feedback is applied to the emitter of TR3 via R16. High frequency feedback is applied to the base of TR4 via C12.

4. REMOVAL FROM CASE

Open the back by pushing the top edge outwards with the thumbs and remove the batteries.

Lay the receiver face downwards on a soft level surface. Remove the handle by pushing downwards from the vertical position. Pull out the 5 pin plug from the amplifier socket and unplug the speaker leads. Now take out the special handle fitting screws from the outside of the case and also the two 4BA screws retaining the chassis to the inside of the case, taking care not to lose the washers. The main chassis may now be removed from the top without difficulty. If necessary, the amplifier can be taken out by removing the two 4BA retaining nuts and washers.

It is necessary to remove the amplifier before the speaker can be removed.

Do not over-tighten speaker nuts when re-assembling, otherwise the frame can be slightly distorted causing the moving coil to touch pole-piece. High sensitivity speakers have very close clearance and can readily be distorted.

5. TEST SPECIFICATION

(a) Audio Amplifier

STATIC VOLTAGES	C	B	E
TR1 meter + ve terminal to junction of R5, R4	4V	1.5V	1.6V
TR2 meter + ve terminal to junction of R10, R3	3.2V	0.625V	-
TR3 meter + ve terminal to HT	0.15V	6.4V	6.7V
TR4 meter + ve terminal to HT	9.1V	0.15V	0
TR5 meter – ve terminal to EARTH	0	9.1V	9.2V
TR6 meter + ve terminal to HT	18V	9.4V	9.2V

(Voltages measured with Voltmeter of 20,000 per volt.)

Audio Tests

Equipment required:– Oscilloscope, audio generator 600 ohms output. Output meter (30 ohms), 0-10M/A DC current meter, 0-10V DC Voltmeter.

Quiescent current and mid-point voltage setting:–

With speaker or output meter connected –

i) Short circuit amplifier input by a link between pin No: 4 and 5 of SK1.

ii) Connect a 0-10 M/A meter between the test link terminals (having first cut the wire link).

iii) Connect a 0-10V Meter between the mid-point voltage test point (which is the junction of R19, R20) and Earth (negative to Earth).

iv) Connect batteries.

v) Adjust RV4 to give quiescent current of 4M/A. Also adjust RV3 to give a mid-point voltage reading of 8.85V.

Re-adjust as necessary, seal RV4. Switch supply 'off'.

Remove meters. Replace link and remove short circuit from input.

NOTE:–It is important at all times to avoid short circuiting the speaker leads as this will result in damage to the output transistors.

Amplifier sensitivity

With Bass and Treble controls set to minimum –

i) Connect oscilloscope and output meter (30 ohms) to the output terminals of the amplifier.

ii) Inject a signal at 1000 c/s from the audio generator at the input of the amplifier to produce 1.2 watts without serious distortion as indicated on the oscilloscope.

The input necessary to give this output should not exceed 40 M/V.

It may be noticed that some uneven clipping of the waveform occurs near the rated power output, if so, adjust RV3 slightly to produce even clipping.

Frequency response

With conditions the same as the sensitivity test. Reduce audio generator output to produce an output of 100 M/W.

Changes in input frequency should produce the following results.

1000 c/s (reference)	0db
50 c/s	–1db
20 Kc/s	0db

(Limits ± 2db)

Tone Control

Keeping reference frequency of 1000 CPs reduce input to produce an output of 10M/W.

i) Change the generator frequency to 50 c/s and rotate the Bass control to maximum. The change from minimum to maximum should produce a change in output of 13db.

ii) Change the generator frequency to 10Kc/s and rotate the treble control to maximum. The change from minimum to maximum should produce a change in output of 14db. The limits in both of these tests ± 3db.

Stability test

With no input to the amplifier but with the output meter or speaker connected, connect oscilloscope to output terminals and note that no oscillations are visible in the trace.

TEST SPECIFICATION

(b) AM Panel **Static Voltages**

	C	B	E	
T1	6.4V	1.0V	0.8V	Measured with receiver switched to M/W.
T2	4.7V	0.9V	0.65V	Voltages with respect to HT+ rail
T3	6.8V	1.05V	0.8V	(Rail voltage 6.8V)

Alignment and Tests

Equipment required:– AM Signal Generator covering 470 Kc/s, 600 Kc/s 1000 Kc/s, 1500 Kc/s, 174 Kc/s, 260 Kc/s
Valve Voltmeter
Wobbulator covering 470 Kc/s.
Oscilloscope.

AM Alignment (IF)

Connect Oscilloscope across C27 (Point B on the circuit diagram) and inject wobbulator and marker signals (470Kc/s) across L1 (M/W aerial coil). Adjust instruments to give a reasonable display on the oscilloscope making sure that the input is kept as low as possible to avoid the effects of A.G.C. action.

Adjust the cores of L4, L5 and L6 to obtain an even response curve with ± 3Kc/s points approximately 3dbs down at either side of the centre frequency of 470 Kc/s.

AM Alignment (RF)

i) Switch to M/W and set pointer at 600 Kc/s (500 metres), inject signal from AM generator via loop at 600 Kc/s and adjust core of

oscillator coil (L3) to give maximum signal as indicated by oscilloscope or output meter connected to output.

ii) Inject, via the loop, a signal of 1500 Kc/s and set the pointer on the receiver to the 1500 Kc/s (200 metres) mark on the scale. Adjust C15 oscillator trimmer for maximum output. Repeat 1 and 2 until calibration is accurate.

iii) With 600 Kc/s signal injected via the loop and the pointer set to the correct mark on the receiver scale, adjust the position of the M/W coil on the ferrite rod for maximum output.

iv) Tune to 1500 Kc/s (200 metres) and adjust C4 for maximum output. Repeat 3 and 4 until no improvement can be obtained.

v) Switch receiver to L/W. Tune in the Light Programme on 200 Kc/s (1500 metres) and adjust C12 for maximum output.

vi) Inject, via the loop, a signal of 167 Kc/s and tune the receiver to this frequency (1800 metres). Adjust the position of the LW coil on the ferrite rod for maximum output.

vii) Inject, via the loop, a signal of 250 Kc/s and tune the receiver. Adjust C6 for maximum output. Repeat 6 and 7 until no further improvement can be obtained.

viii) Fix the coils carefully in position on the ferrite rod with adhesive tape.

IF Sensitivity

Measured with receiver switched to M/W and gang closed.

With signal generator (10 ohms source) adjusted to 470 Kc/s 30% modulation at 400 cycles per second (C.P.S.), connected across L1 (M/W aerial coil) and valve voltmeter connected across RV1. Adjust generator output to give 7.8 millivolts on valve voltmeter. The generator output required to give the reading should not exceed 50 microvolts.

RF Sensitivity

For the same valve voltmeter reading (7.8 millivolts) a signal at RF 30% mod. at 400 C.P.S. injected into the car aerial socket via 400 ohms dummy aerial should require not more than the following input levels.

Medium Wave	Long Wave
600 Kc/s = 23 micro volts.	174 Kc/s = 32 micro volts.
1000 Kc/s = 9 micro volts.	260 Kc/s = 10 micro volts.
1500 Kc/s = 4.5 micro volts	

Oscillator Drive

Measured with valve voltmeter connected between emitter of T1 and chassis.

M/W = 50-70 M/V
L/W = 30-40 M/V

TEST SPECIFICATION

(c) FM Panel

Static Voltages

(Measured with respect to HT + rail)		C	B	E
	T6	8.0V	1.8V	1.6V
	T7	7.4V	1.05V	0.8V
	T8	7.6V	1.0V	0.7V
	T9	7.4V	2.4V	2.1V

Measured with R28 set at <u>minimum</u> resistance position. Rail voltage 8V. Voltage measured at Pin 3 of tuner unit 1.5V.

NOTE:–No static voltages other than the test voltage at Pin 3 are given for the VHF tuner unit as it is recommended that this item is returned to us in the event of failure.

FM Alignment and Tests

Equipment required:– Sweep generator covering 10.7 Mc/s.
RF generator covering 10.7Mc/s and 88-100Mc/s.
FM and AM (30% AM modulation).
Oscilloscope.
Valve voltmeter.

NOTE:–Before any FM measurements are carried out, the potential between pin 3 of the tuner and HT rail should be checked. If not –1.5V the adjustment of R28 should correct this.

FM Alignment

Disconnect input from VHF tuner unit to base of T6 and remove AFC by connecting a link between AFC line and chassis. Connect sweep generator to base of T6 via a 22pf condenser. Adjust sweep generator and marker to 10.7 Mc/s.

Connect oscilloscope across the volume control (RV1) and adjust equipment to give 'S' curve. Adjust the cores of L15, L14, L13 and L12 to give 'S' curve display of width ± 100 Kc/s either side of the IF frequency, adjusting for maximum linearity of the straight portion of the curve, consistent with optimum gain and symmetry about the centre frequency. When satisfied that no further improvement can be obtained, remove input. Feed into the external aerial socket of the receiver an FM signal of 91 Mc/s (30Kc/s deviation), tune receiver to this point on

the scale and adjust C42, C35 and L11 in this order, for maximum output as indicated on the oscilloscope. Remove shorting link from A.F.C. line. Check AFC action.

AFC Check

With unmodulated signal generator input at 90Mc/s, fed into aerial socket and valve voltmeter connected across C72, adjust input level until 3.0 volts is indicated on meter.

Variation of generator frequency ± 200 Kc/s either side of the tuning point should produce a change in meter reading of + or – 0.4V.

6. POSSIBLE FAULTS AND THEIR CORRECTIONS

Noisy Bass Control	Suspect leaking or short circuit C7 or C10	Replace
Incorrect operation of Treble and Bass controls	C10 short circuit or open circuit	Replace
Noisy Treble control	Suspect leaking C6	Replace
High battery consumption	Incorrect adjustment of RV4	Adjust as per test
Distortion (AM and FM)	Incorrect adjustment of RV3	Adjust as per test
	Leaking coupling condensers in amplifier	Check and replace
Distortion (FM only)	Discriminator off alignment	Re-align
Incorrect AFC operation (FM)	Check modification No.5 Check alignment	
Instability or low gain (FM)	Check adjustment of R33 preset gain control	
	Check decoupling throughout FM panel	
Microphony (FM)	Check modification No.4 Check that there is no undue restriction of leads connecting VHF tuner to main chassis. Examine for displacement of VHF tuner or bending of mounting bracket etc., due to damage in transit.	
Distortion (AM)	Check A.G.C. and operation of overload diode CR1	
Low gain or instability (AM)	Check decoupling condenser throughout AM panel.	

7. MODIFICATIONS

1. Value of C7 on switch printed panel increased from 80pf to 90pf.

2. Value of C20 on AM panel increased from 2mfd to 50mfd.

3. Value of C19 on AM panel increased from 100mfd to 300mfd.

4. To prevent microphony in VHF tuner, a piece of foam plastic 1½" x 1" x ¼" applied by means of adhesive to the back of the unit.

5. To improve AFC operation, points 'V' and 'W' on FM panel are now linked together.

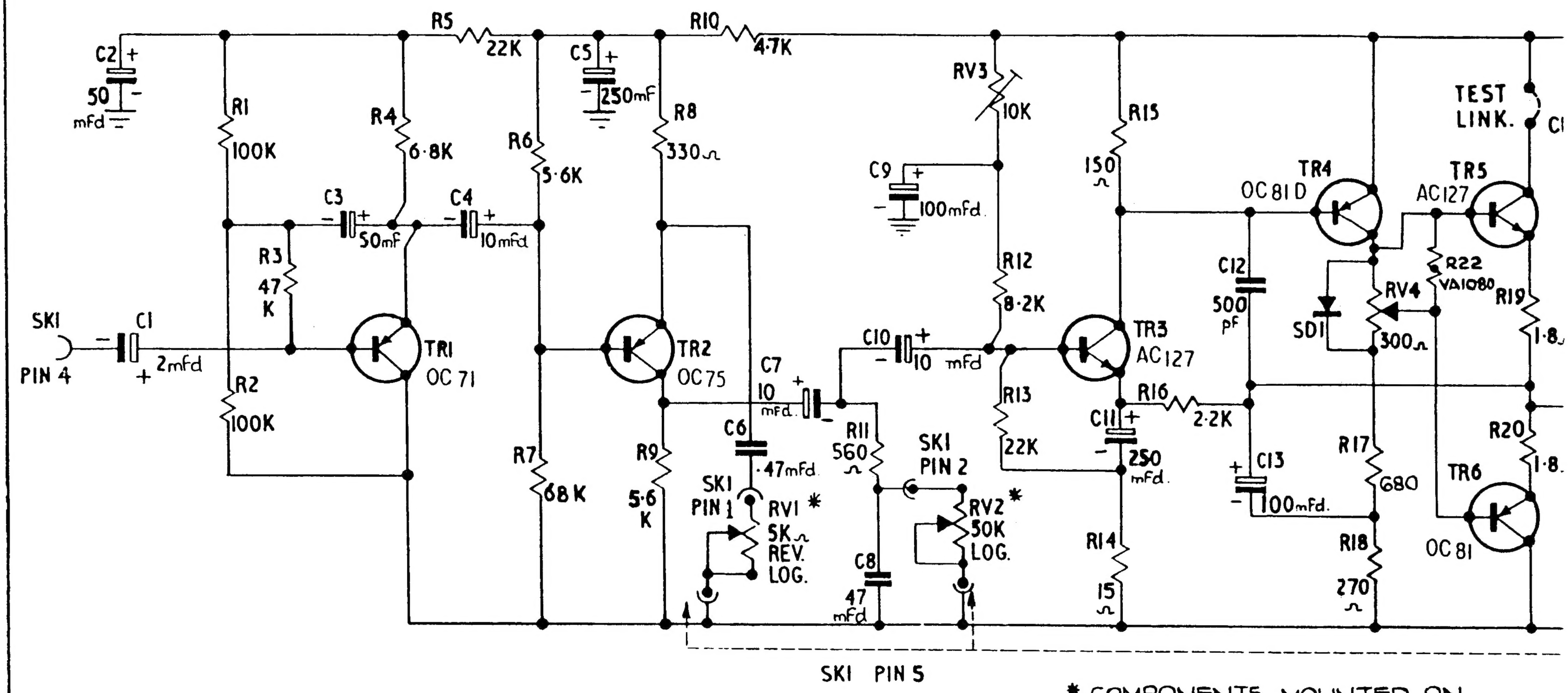
6. To improve stability factor on FM, C76 (.005mfd) added between Tag 5 and E (Tag 4) on IF board.

7. R39 and R43 changed from 220 ohms and 470 ohms to 470 ohms and 680 ohms respectively.

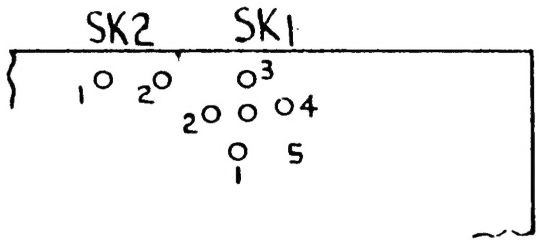
8. PRICE LIST OF REPLACEMENT COMPONENTS

Circuit Ref:	Part	Price £.	s.	d.
	VHF Tuner Unit – Görler 312–0031	6.	5.	0
L3	Oscillator coil P55/1D		6.	0
L4	IF Transformer 470Kc T41/1E		9.	9
L5	IF Transformer 470Kc T41/2E		9.	9
L6	IF Transformer T41/3C		11.	9
L1	MW Aerial Coil		4.	6
L2	LW Aerial Coil		4.	6
	10" Ferrite rod		4.	0
L12	IF Transformer 10.7Mc/s T41/3K		9.	0
L13	IF Transformer 10.7Mc/s T41/3K		9.	0
L14	IF Transformer 10.7Mc/s T41/3K		9.	0
L15	IF Transformer 10.7Mc/s T41/4R2		10.	3
LS	Speaker 8" x 5"	1.	6.	3 + P.Tax
	Telescopic Aerial		19.	0
	Tuning Scale		13.	3
	Turntable		5.	0
	Speaker grille	1.	1.	0
	Rear cabinet grille		1.	9
	Knobs (Tuning and volume)		2.	0 each
	Knobs (Tone)		1.	9 each
	Push button switch		15.	0
RV1	Volume Control (50K DPS)		6.	6
R28	Preset AGC level control (15–50K ohm)		1.	6
R33	Preset IF Gain control (150 ohm)		1.	6.
RV1 (Amp)	Treble control (5K ohm)		3.	6
RV2 (Amp)	Bass control (50K ohm)		3.	6
RV3 (Amp)	Mid point voltage control (10K ohm)		1.	6
RV4 (Amp)	'Q' Current setting control (300 ohm)		2.	0
Amplifier				
TR1	OC71 Transistor		6.	6.
TR2	OC75 Transistor		8.	0
TR3	AC127 Transistor		9.	6
TR4 TR5 TR6	OC81D Transistor) AC127 Transistor) Set of 3 LFK4 OC81 Transistor)	1.	5.	6
Tuner				
T1-T3	AF117 Transistor		9.	6
T6-T9	AF114 Transistor		11.	0 each
Accessories				
3.5mm Continental jack plug			1.	6 each
Earphone			10.	6
Carrying case		2.	2.	0

ISSUES
2. 18.6.64 C7 POLARITY REVERSED
3. 8.9.64 SOCKET PIN Nos CORRECTED
4. 22.9.64 INSET DETAIL ADDED FOR RP30 & RP31. POLARITY OF C1 REVERSED
5. 30.9.64 R11 WAS 33Ω R17 WAS 1.2K R22 ADDED



* COMPONENTS MOUNTED ON SCALE PAN CHASSIS.



LOCATION OF SOCKET PINS ON COMPONENT SIDE OF PANEL.

HACKER RA

AMPLIF

CIRCUIT D

CHECKED	DATE.
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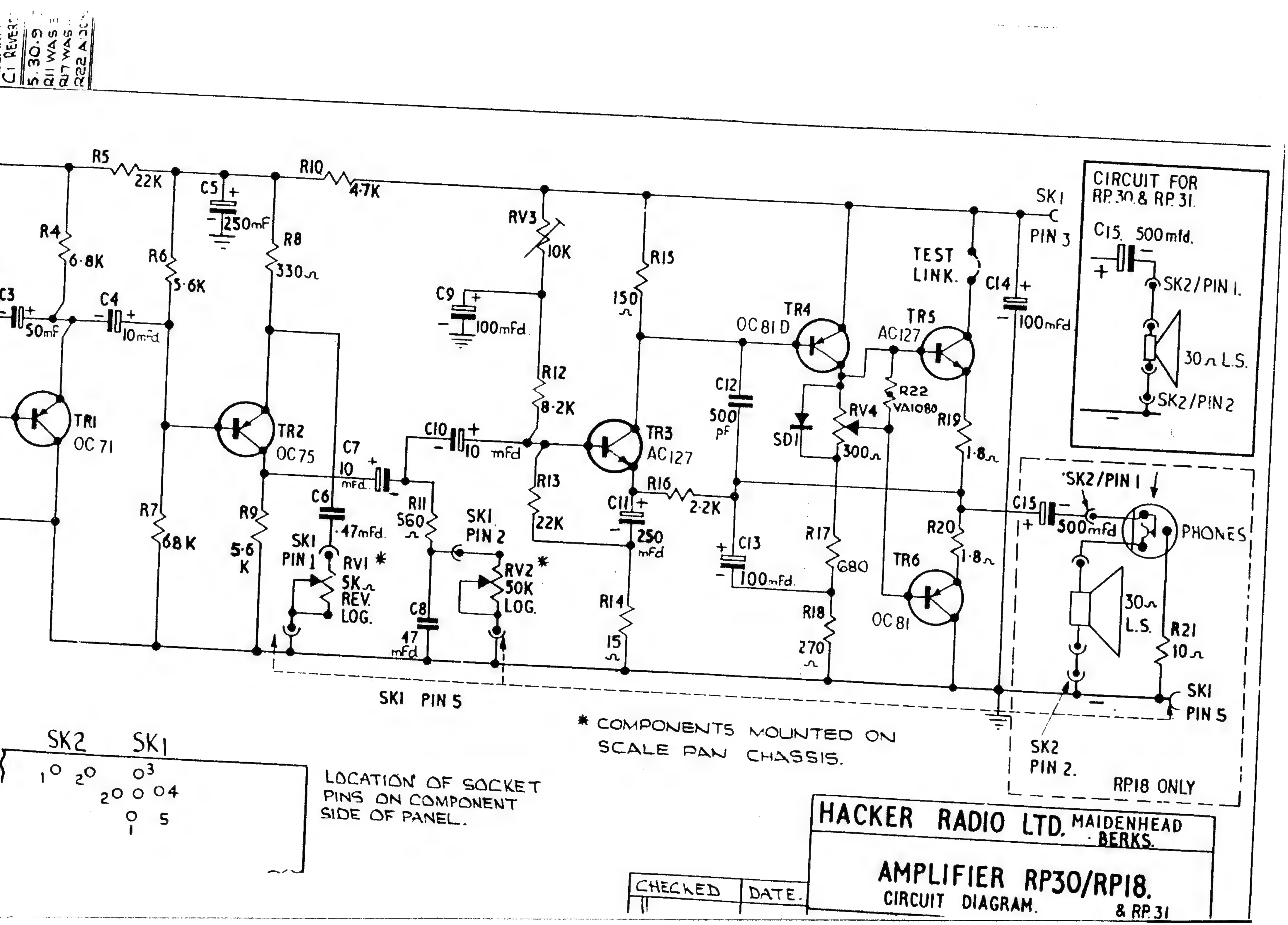
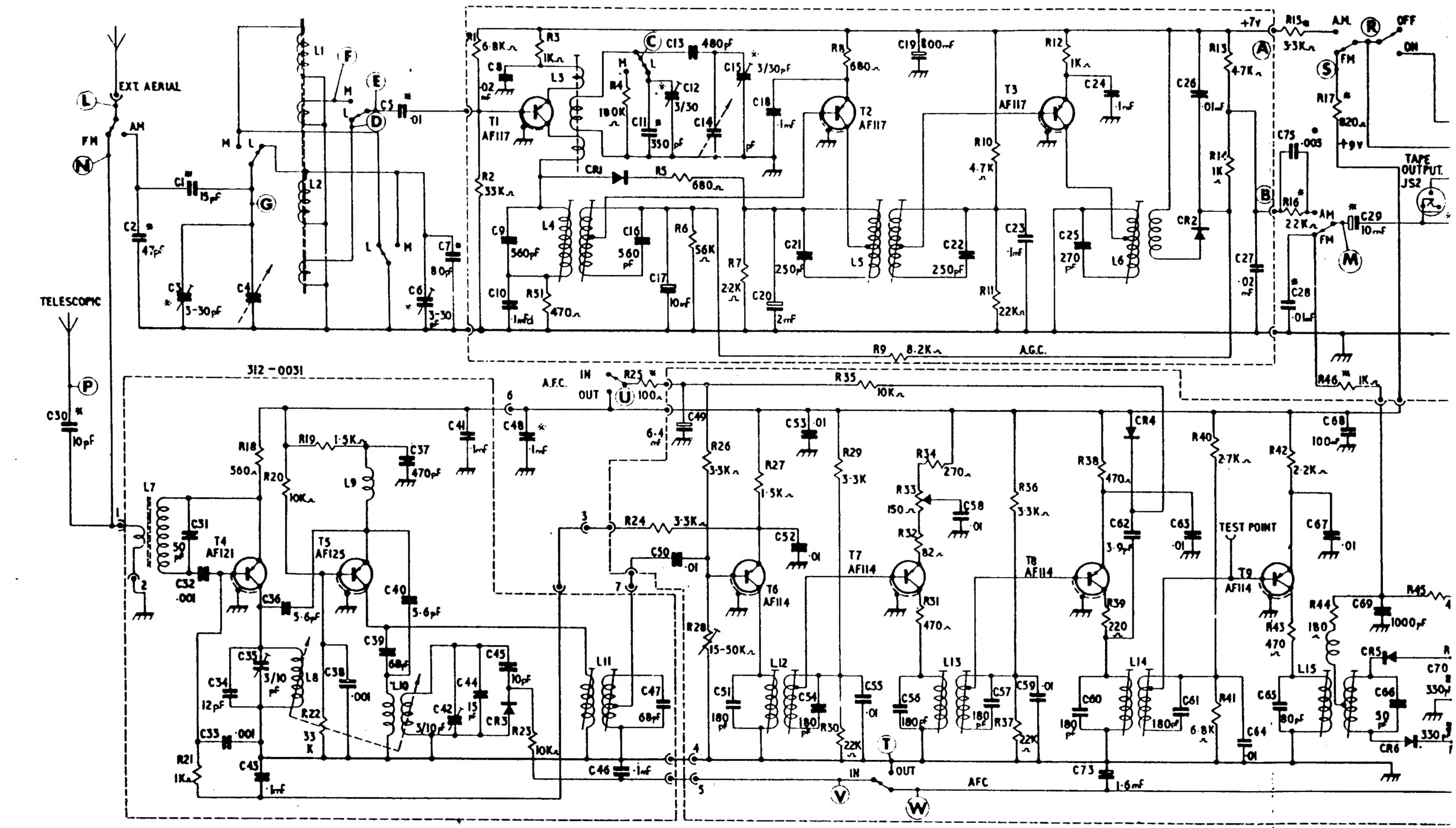
DRN: I.M.H. DATE: 23.



CIRCUIT FOR RP.30 & RP.31.
C15. 500 mfd.
SK2/PIN 1.
30 Ω L.S.
SK2/PIN 2
R5 22K
R10 4.7K
C5 250mF
R4 6.8K
R6 5.6K
R8 330 Ω
RV3 10K
C9 100mFd.
R15 150 Ω
SK1 PIN 3
TEST LINK.
C14 100mFd.
C3 50mF
C4 10mFd
TR1 OC71
TR2 OC75
R7 68K
R9 5.6 K
C7 10 mFd.
C6 .47mFd.
SK1 PIN 1
RV1 * 5K Ω REV. LOG.
C10 10 mFd
R11 560 Ω
SK1 PIN 2
RV2 * 50K LOG.
C8 47 mFd
R12 8.2K
R13 22K
TR3 AC127
C11 250 mFd
R14 15 Ω
R16 2.2K
TR4 OC81D
C12 500 pF
C13 100mFd.
SD1
RV4 300 Ω
R17 680
R18 270 Ω
TR5 AC127
R22 VA1080
R19 1.8 Ω
R20 1.8 Ω
TR6 OC81
'SK2/PIN 1
C15 500mFd
PHONES
30 Ω L.S.
R21 10 Ω
SK1 PIN 5
SK2 PIN 2.
RP18 ONLY
SK1 PIN 5
* COMPONENTS MOUNTED ON SCALE PAN CHASSIS.
SK2 SK1
1 2 3 2 4 5 1
LOCATION OF SOCKET PINS ON COMPONENT SIDE OF PANEL.
HACKER RADIO LTD. MAIDENHEAD BERKS.
AMPLIFIER RP30/RP18. & RP.31
CIRCUIT DIAGRAM.
CHECKED
DATE.

ALSO SHOWN ON RP18 AMPLIFIER CIRCUIT CD/18/2.—



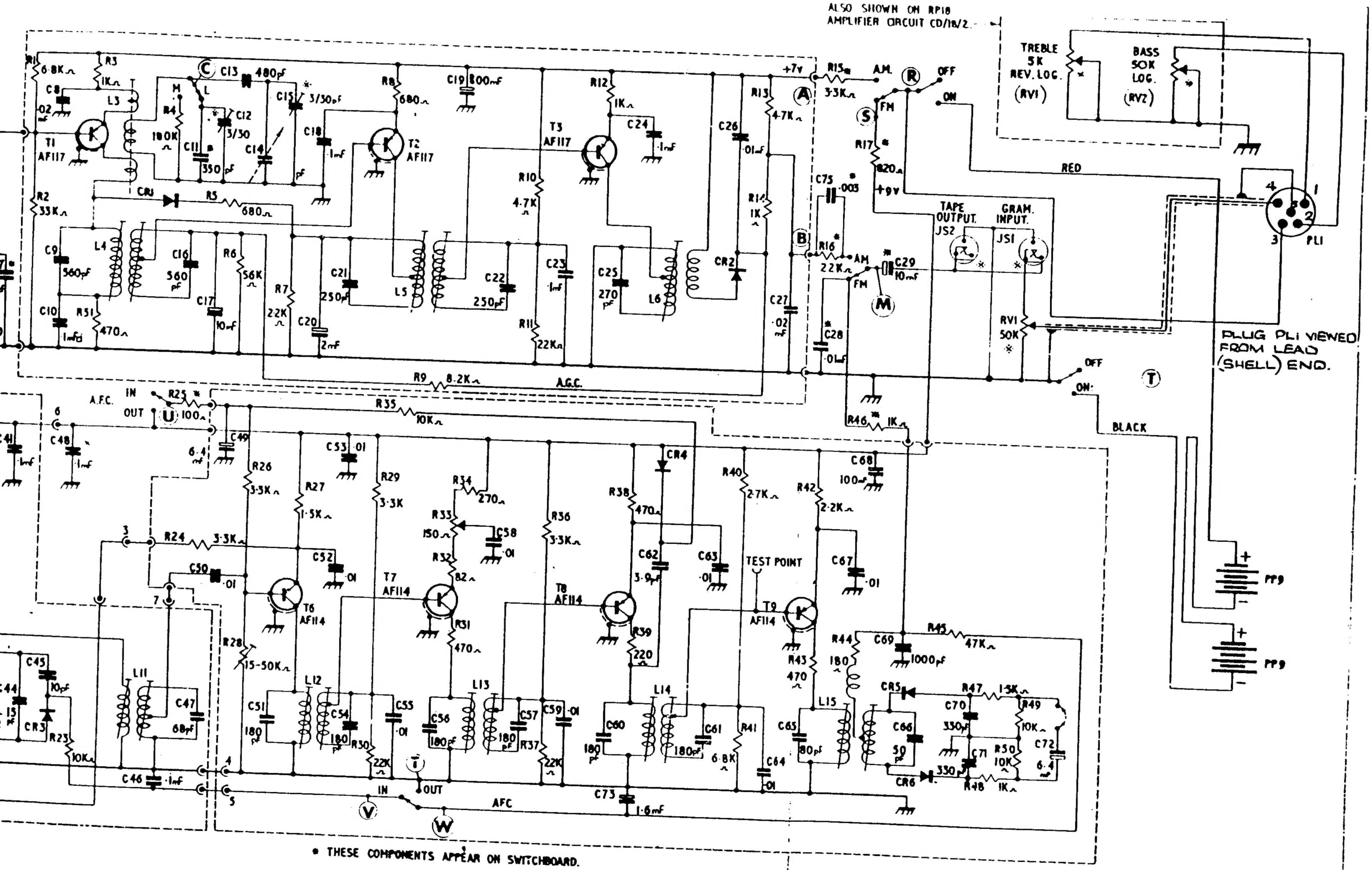
• THESE COMPONENTS APPEAR ON SWITCHBOARD.

(A) INDICATES TERMINATIONS ON SWITCH PRINTED PANEL.

✻ COMPONENTS MOUNTED ON SCALE PAN.

ISSUES 23.3.64 9.9.64

CHKD	DATE

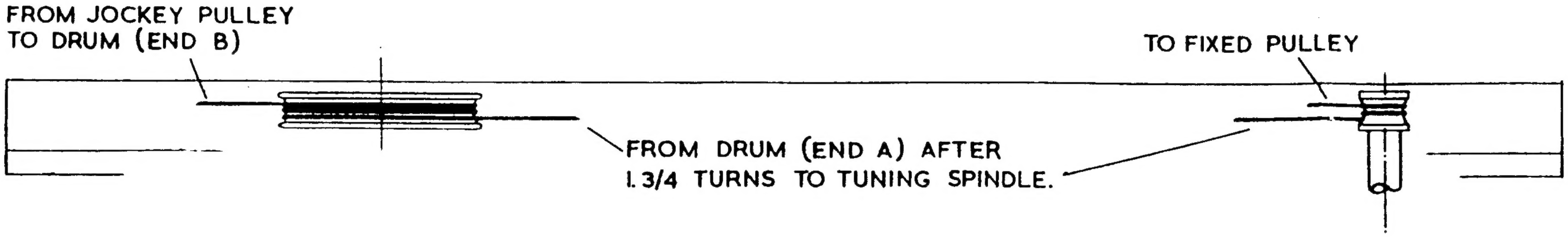


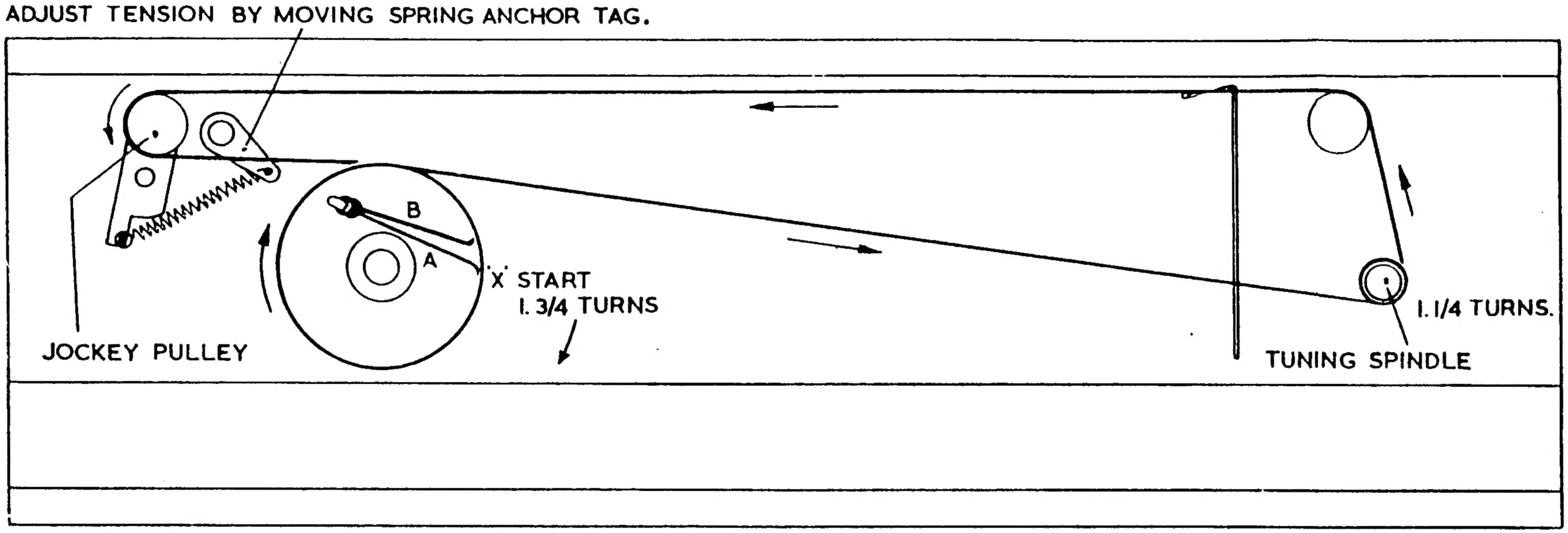
• THESE COMPONENTS APPEAR ON SWITCHBOARD.

(A) INDICATES TERMINATIONS ON SWITCH PRINTED PANEL

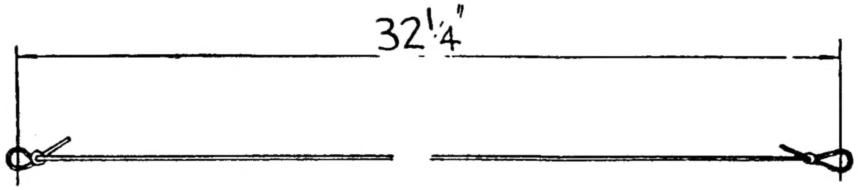
✻ COMPONENTS MOUNTED ON SCALE PAN.

HACKER RADIO LTD. MAIDENHEAD. BERKS.	
CIRCUIT DIAGRAM. TUNER RP18.	
CHKD	DATE
DRN: JMH	DATE: 23.3.64
DRG. NO. CD/18/3.	





ASSEMBLY DRAWN WITH POINTER AT END OF TRAVEL.
ARROWS INDICATE DIRECTION OF TRAVEL WHEN
TUNING SPINDLE IS TURNED ANTI-CLOCKWISE.

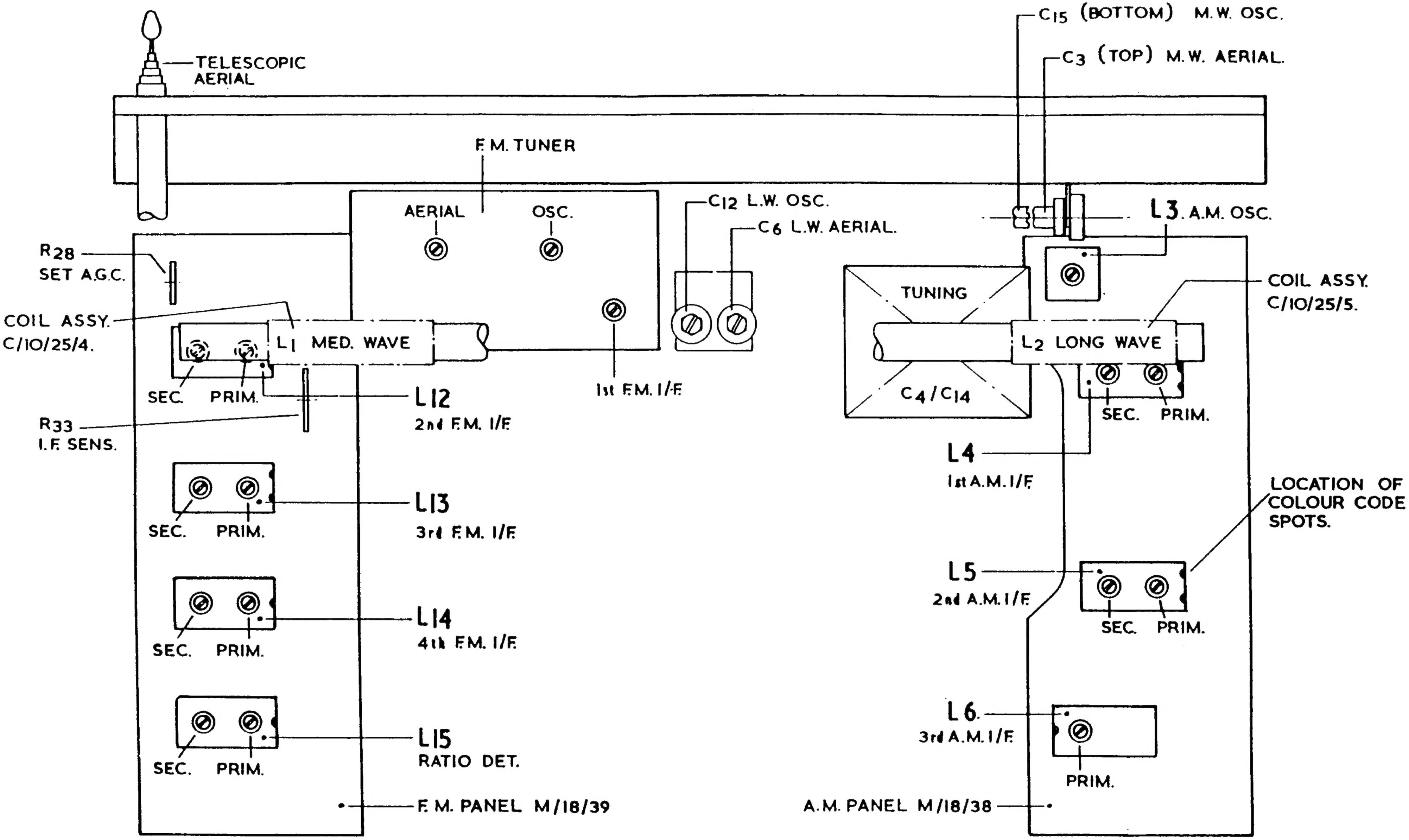


STRETCHED LENGTH WITH ENDS TIED AND KNOTTED
ROUND 2 PINS 1/8" DIA. KNOT TIES TO BE
IMPREGNATED WITH QUICK-DRYING VARNISH.

CORD:- SUFLEX NYLON GLASS.

CORD ASSY. DETA
RP. 18 PORTABLE.

DRAWN	DATE	HACKER RADIO LTD. MAIDENH
CJC	15.9.64	RP. 18 PORTABLE. SERVICE DATA.
		DRG. No: CD/18/30



<u>USE IN CONJUNCTION WITH CIRCUIT DIAGRAM CD/18/3.</u>

<u>BLOCK LAYOUT, TRIMMER LOCATION.</u>

DRAWN	DATE	HACKER RADIO LTD. MAI
G/c	13. 9. 64	RP 18 PORTABLE. SERVICE
CHECKED		